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MAKING AND PRESERVING

APPLE CIDER



U.S. DEPARTMENT OF AGRICULTURE - FARMERS' BULLETIN NO. 2125

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MAKING AND PRESERVING APPLE CIDER

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Cidermaking is an art as old as the cultivation of apple trees. Until about 1930 apple cider was made and consumed in greater quantities than any other juice. Since then, production has decreased. This decrease can be partly attributed to the rapid increase in the commercial canning of other juices.

However, apple cider with its own distinctive appeal has never lost its particular place among the beverages. The market potential for good "country" cider is increasing. It can be an important and profitable source of income to applegrowers in all parts of the country.

PREPARATION

Selecting and Blending the Apples

The starting point in cider-making is the judgment and discrimination of the cidermaker himself. By carefully selecting and blending the apples, a reputation can be built for making good cider at all times. Instead of taking the "ciders" as they come, a little manipulating of the available fruit gives the best practical combination of characteristics for each batch.

There are no hard and fast rules or formulas to follow, but the two most important factors to consider are maturity and variety.

Maturity

Firm-ripe apples—those that are ripe enough to eat out of hand—make the best cider and give the highest yield. Immature or overripe apples lower the quality. Early-maturing varieties should be allowed to ripen sufficiently to yield a high-quality juice. The practice of storing the fruit as harvested allows closer control of maturity and blending of the cider lots.

Variety

Every variety offers a medley of characteristics, one or more of which may come through predominantly in the juice.



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An attractive roadside market promotes sale of apple cider.

The best cider is usually made from a blend of different varieties of apples. A blend provides an appealing balance of sweetness, tartness, and tang, as well as aromatic overtones.

A single variety of apple seldom makes a satisfactory cider. However, a few of the familiar varieties — Gravenstein, Newtown-Pippin, and McIntosh—have been used alone successfully, but only at the peak of their maturity.

Sometimes the desired fullness and balance can be obtained from two varieties. A blend of three or more varieties is better. Using several varieties permits greater latitude in varying the proportions to obtain the desired blend, and also allows practical management of the available supply.

Varieties that have a somewhat neutral juice flavor—such as Rome Beauty—often may be

used in fairly large proportions because of their ability to pick up and merge the more pronounced flavors of other available varieties.

To make sure you get a premium-quality cider, taste-test samples of each lot of apples, also samples of trial blends of juices.

Many commercially important varieties may be separated into four groups according to their suitability as cider material: Sweet subacid, mildly acid to slightly tart, aromatic, and astringent. A strict classification is not possible because many varieties have a number of different flavor characteristics. For example, Delicious may be listed in both the sweet subacid and aromatic groups. Moreover, varieties differ in their characteristics from one area to another.

Varieties in the sweet subacid

group are grown primarily for eating raw; they usually furnish the highest percentage of the total stock used for cider.

Varieties in the aromatic group have outstanding fragrance, aroma, and flavor that are carried over into the cider.

Crabapples, in the astringent group, provide tannin—a constituent difficult to obtain in making a high-grade cider. The juices of this astringent group also are highly acidic. Only a small quantity of these apples should be used in the blend.

Use the following list as a guide in selecting the right blend of varieties.

Sweet subacid group: Baldwin, Hubbardston, Rome Beauty, Stark, Delicious, Grimes, Cortland.

Mildly acid to slightly tart group: Winesap, Jonathan, Stayman, Northern Spy, York Imperial, Wealthy, R. I. Greening, Newtown-Pippin.

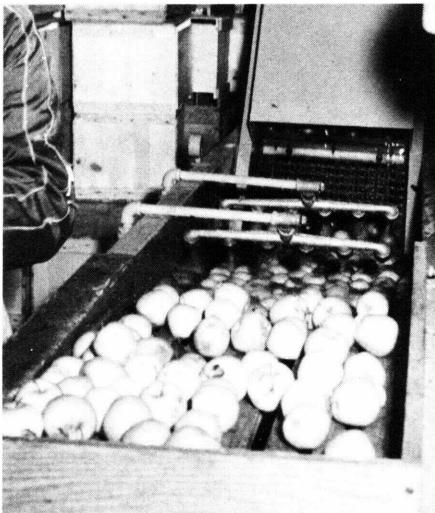
Aromatic group: Delicious, Golden Delicious, Winter Banana, Ribston, McIntosh.

Astringent group: Florence Hibernal, Red Siberian, Transcendent, Martha.

Grading and Washing the Fruit

Always use sound, clean apples. They may be the small sizes, promptly gathered drops, fruits sorted out of the market grade because of mediocre color or finish, or an occasional tree-run lot.

Generally, apples coming from the grader line need no additional sorting. Washing the fruit prior to grinding is advisable. A good plan is to place the washer so that it feeds into the elevator that leads to the grinder. Several types of washers can be used: A



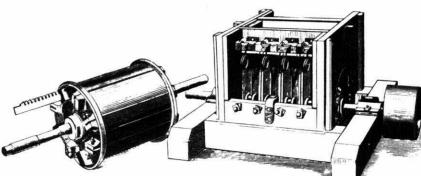
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An inspection belt and spray rinse are useful in large-scale production of cider.

rotating cylinder in a continuous flow of water, a wet-brush and spray, or a roller-bath. Regardless of the type used, it is best to finish the washing operation with a high-pressure water blast. For small operations, dump the apples into a tank or large tub and grade and wash them by hand.

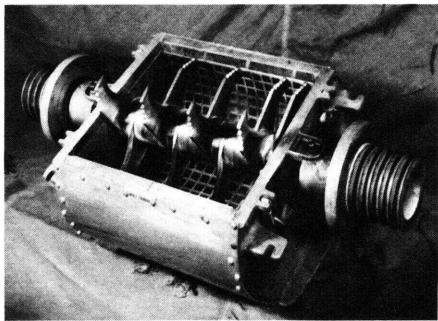
Grinding the Fruit

Two types of machines are available to break up the fruit for pressing—a grater and a hammer mill.



BN-6885X

An apple grater disassembled to show the cylinder and grater knives.



B-2793

A typical hammer mill used for grinding cider apples.

A grater consists of a cylinder equipped with 3 or 4 serrated pieces of steel, or teeth, that project not more than one-fourth inch above the cylinder surface. The whole assembly revolves at high speed. The cylinder is adjusted for a clearance of one-sixteenth inch or less between the housing plates and the cylinder teeth. Graters are available in

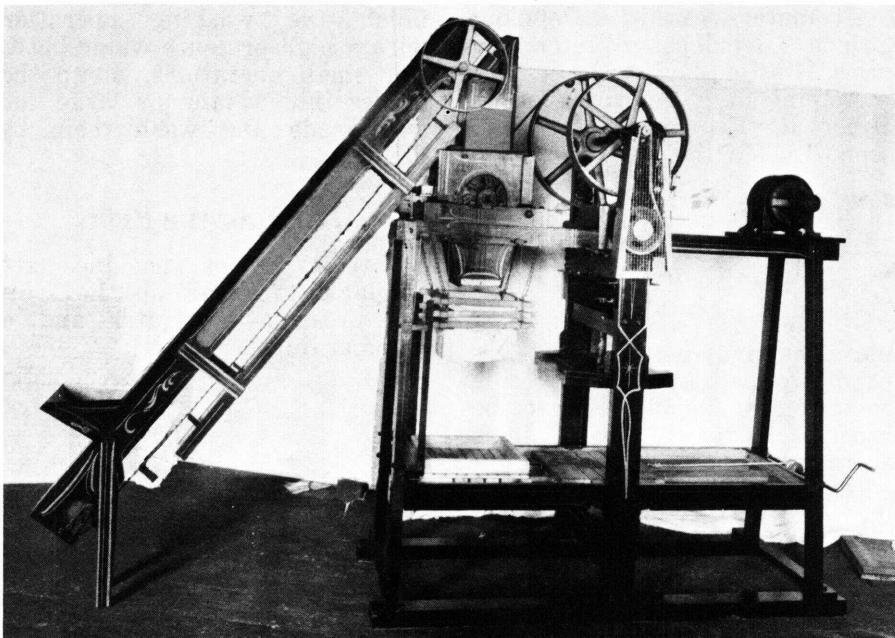
sizes that break up eight bushels to several hundred bushels of apples an hour.

A hammer mill consists of stainless steel bars evenly spaced on a shaft that revolves at high speed. A semicircular perforated screen is attached to the bottom of the mill. Screens are available in mesh sizes from $\frac{3}{8}$ to $\frac{3}{4}$ inch. Larger sizes are used for ripe fruit, smaller sizes for fruit of lesser maturity. Screens may be easily removed for cleaning or changing sizes.

The hammer mill has a larger capacity than the grater; it can be cleaned more easily and gives a higher yield of juice. However, it requires more horsepower to operate.

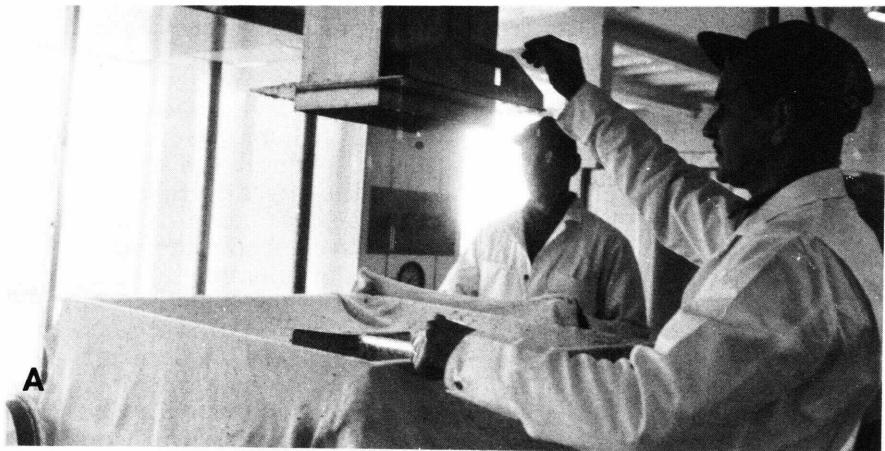
Pressing

Equipment for grinding and pressing is usually combined into one machine—the cider press.

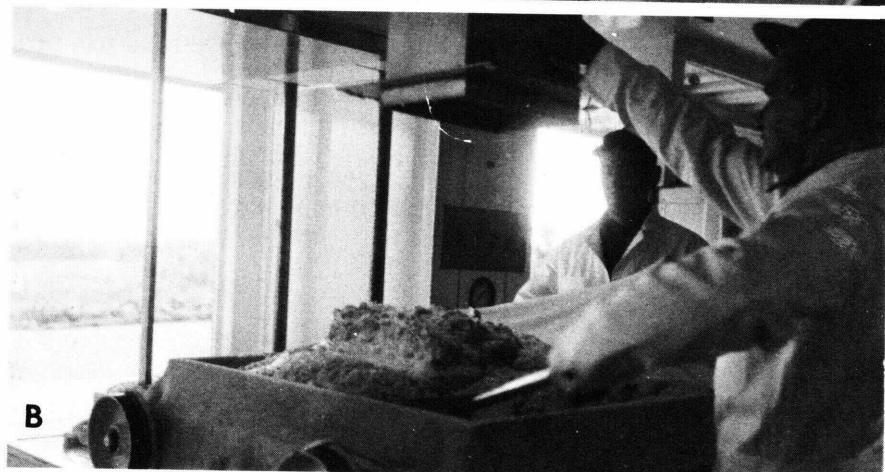


BN-6883x

A typical commercial press, including the elevator and grinder.



A



B



C

Steps required to form the "cheeses" for pressing.

BN-6884x

Presses range in capacity from 100 to 1,000 bushels a day.

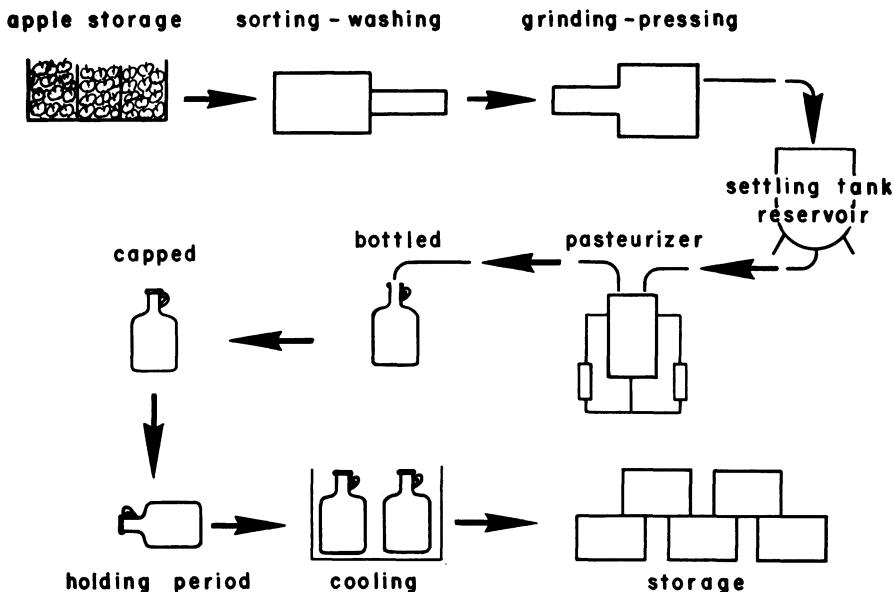
Two types of cider presses are available. The mechanical press uses a heavy screw for pressure. The hydraulic press uses a hydraulic ram to exert pressure against the apple pulp. Both types use slatted racks and press cloths to hold the pulp for pressing.

To load the press, lay the slatted rack, or press board, on the pressing platform. Place the square frame on the press board and cover it with a press cloth. The corners of the cloth should extend over the sides of the frame. Fill the frame with apple pulp. Be sure that the corners of the frame are well filled. Then fold the cloth over the pulp and remove the form. This makes the

first of several layers, or "cheeses."

Lay another press board on top of the first layer, place the frame on it, and prepare the second cheese. Repeat this procedure until the press is filled. Finally, place a press board on top of the last cheese. Apply pressure to the cheeses gradually, to avoid rupturing the press cloths. Build up the pressure to approximately 150 pounds per square inch and hold for several minutes. Most gages show pressure on the ram and not the pressure per square inch on the cheese.

Commercial press sizes are listed according to the dimension of the square frame: 17-inch, 22-inch, 36-inch, 42-inch, and 52-inch. A 17-inch press will produce 200 to 300 gallons of juice in a 10-hour day.

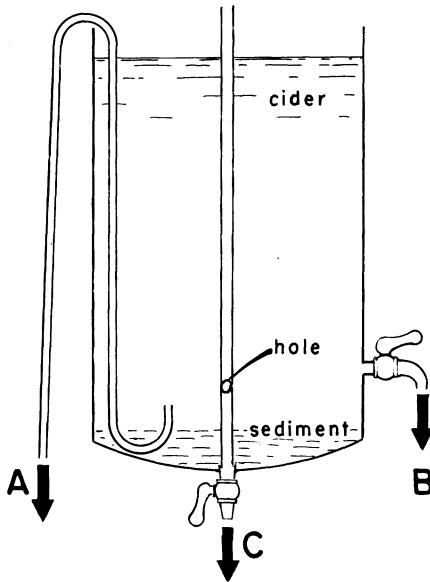


This flow chart shows the essential steps in the production of cider.

Juice Sedimentation

As soon as the juice is pressed from the fruit pulp, strain it to remove coarse particles, and then pump it into a temporary storage tank. The length of time for proper sedimentation may vary. Most juices take 12 to 36 hours to settle. If the temperature of the juice can be kept at 40° F. or less, it may be held in the settling tank for 24 to 72 hours without danger of fermentation.

When settling is completed, the juice must be drawn off without disturbing the sediment. This is commonly done by siphoning, tapping, or draining. Other methods for removing sediment include heat treatment, centrifuging, filtration, and enzyme clarification. These treatments are seldom used in small-scale cider operations.



Three methods of drawing cider from the settling tank: A. siphoning; B. tapping; and C. draining.

PRESERVATION

Four methods are commonly used for preserving cider: Refrigeration, freezing, pasteurization, and preservation by chemicals.

Refrigeration

Refrigeration is one of the most economical methods of preserving cider. Cider cooled immediately after pressing and stored at a temperature between 32° and 36° F. retains its original flavor for 1 to 2 weeks without danger of fermentation. Settling can take place under refrigeration.

Refrigeration is especially adaptable where cold storage facilities for fresh fruit are available. If a refrigerated room is not

available, the operator can install an insulated metal or wooden tank and cool the cider with a small refrigeration unit.

Freezing

The best method known for preserving the fresh flavor of cider is freezing. Frozen cider retains its quality for at least a year. No heat treatment is needed. Freeze the juice as soon after settling as possible. Use containers of tin, glass, or plastic and fill them to only 90 percent of capacity to allow for expansion of the juice on freezing.

Pasteurization

Pasteurized cider keeps indefinitely without fermenting. The

juice is heated to 170° F. and held for 10 minutes. A higher temperature or a longer holding period may result in a cooked flavor. Use a metal-stemmed thermometer to check the temperature; a glass one may break and contaminate the product. Three methods of pasteurization are generally used.

Batch pasteurization

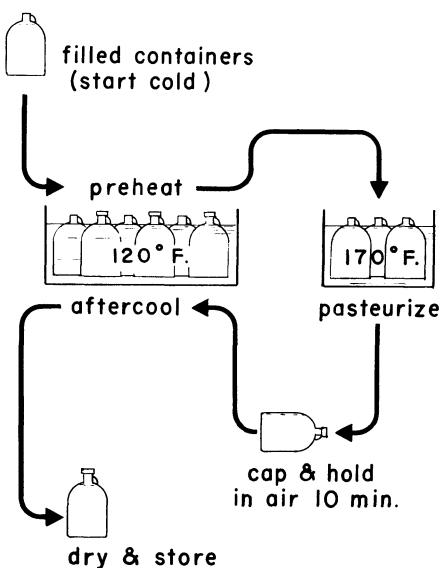
Fill a stainless steel or aluminum container with cider, cover, and heat to 170° F. Pour the hot cider immediately into a clean jug that has been preheated with warm water and cap at once. Place the jug on its side for 10 minutes to allow the hot cider to sterilize the cap. Then place the jugs in a tub or sink containing lukewarm water (110° to 120° F.) Remove the jugs after several minutes and allow them to cool in the air.

This method of pasteurizing is satisfactory for batches of 50 gallons or less. Always use a non-corrosive metal container for heating the cider. A pour spout at the bottom of the container is helpful in filling the jugs.

Semicontinuous pasteurization

This method requires two water-bath tanks as shown on page 11. The first tank contains water heated to 120° F. Place jugs filled with cold cider in this tank and hold them for at least 5 minutes. Then transfer jugs to the second tank and hold them until the temperature of the cider is brought to 170° F. Remove jugs, cap tightly, and place them on their sides for 10 minutes to sterilize the caps. Return the jugs to first tank for aftercooling.

Semicontinuous pasteurization processes the cider at a faster rate than batch pasteurization.



A flow chart of the semicontinuous method of pasteurization.

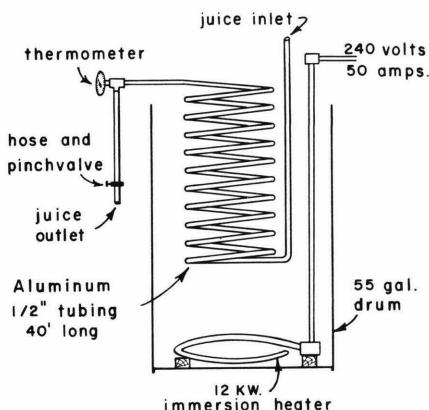
The preheating step permits greater fuel saving, because the water in the preheating tank is kept warm from the heat of the freshly pasteurized juice.

Continuous pasteurization

Equipment for this process consists of a coil of thin-walled aluminum tubing immersed in a tank of hot water. An immersion-type electric heater may be used to heat the tank.

Cider flows from the settling tank reservoir through metal or rubber tubing to the heating coil. The reservoir outlet should be at least 6 feet above the discharge end of the system.

Adjust the flow of cider so that it comes out of the coil at a temperature of 170°F. If the cider rises above or drops below 170° F., increase or decrease the flow by adjusting the setting of the valve or pinch clamp near the thermometer.



A home-built continuous pasteurizer heated by electricity.

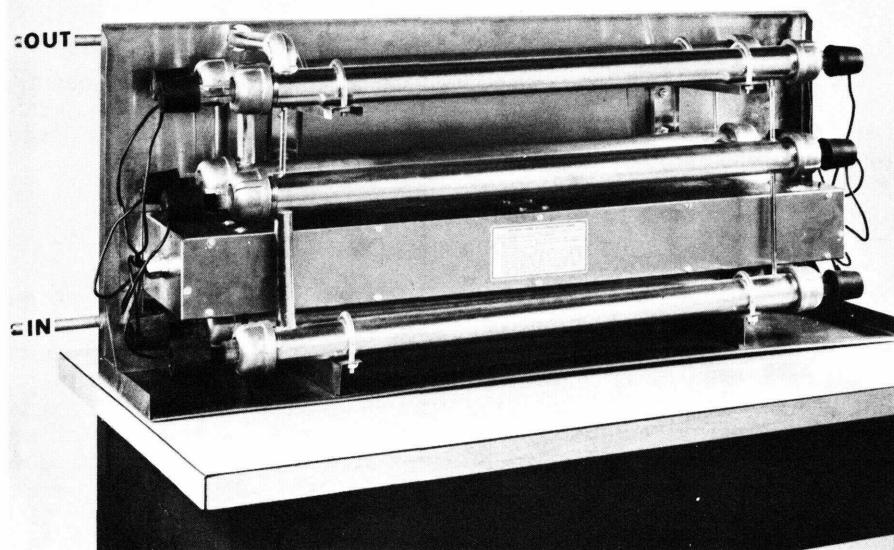
Preheat containers before filling them with the hot cider, then seal. Lay each container on its side for 10 minutes to sterilize the cap. After the holding period, place the containers in a bath of lukewarm water for cooling. Pack cooled containers in cases and place in storage until needed.

The continuous pasteurization method heats the cider to a high temperature in a short time. It gives a high-quality product and is one of the most commonly used methods.

Complete construction details and a list of materials for building a homemade pasteurizer of this type may be obtained by writing the Eastern Utilization Research and Development Division, Agricultural Research Service, U.S. Department of Agriculture, 600 E. Mermaid Lane, Philadelphia, Pa. 19118.

Ultraviolet Irradiation

Ultraviolet (UV) irradiation considerably extends the refrigerated shelf life of cider without altering the flavor. UV light destroys most, but not all, of the microorganisms in fresh cider. The photograph shows a six-lamp commercial unit capable of treating 50 gallons of cider per hour. Larger units are also available.



Commercial ultraviolet irradiation unit for apple cider.

B-4200

The cost of UV treatment is about 1 cent per gallon. If the cider is first clarified or filtered, the treatment is more efficient.

Since UV treatment does not completely sterilize the cider, regrowth of spoilage microorganisms must be retarded by refrigeration. For still further protection, potassium sorbate (preferably 0.03 to 0.05 percent) can be added to the cider *after* irradiation.

Chemical Preservation

Chemicals may be used to preserve cider for a few days or weeks. Potassium sorbate, a relatively tasteless material, is preferred instead of benzoate of soda and is just as effective. Benzoate of soda imparts a burning taste that many people find objectionable.

Add potassium sorbate to the cider as soon as possible after pressing. If the cider is to be

stored at room temperature (70° F.), add 0.10 percent by weight of potassium sorbate, the maximum permitted by law. Thus, 1 gallon of a 25-percent solution of potassium sorbate would be sufficient for 250 gallons of cider, or 1 ounce for 2 gallons. Because potassium sorbate is only slightly soluble in cider, add it to the cider slowly and stir vigorously.

Mild refrigeration (50° F. or below) greatly increases the effectiveness of potassium sorbate. At this temperature 0.05 percent of the solution preserves cider for several weeks.

It is recommended that you consult your State health department concerning regulations governing the use of potassium sorbate.

If potassium sorbate is not available in your area, consult your State experiment station or write to the U.S. Department of Agriculture for information on sources of supply.

CIDER CONTAINERS

Glass Jugs

Gallon and half-gallon glass jugs are used most often for fresh cider. These jugs are usually of the narrow-mouth type and are fitted with metal screw caps or corks. Clean containers and caps thoroughly with hot water and a good detergent before filling. If you pasteurize your cider, select glass containers that are capable of withstanding rapid temperature changes. Less breakage will occur if the jugs are heated and cooled gradually. Use screw caps fitted with rubber gaskets rather than cardboard linings. The gaskets insure a tight seal even on rough-lipped bottles.

Clear glass containers permit customer inspection of the product and thus provide a certain amount of sales appeal.

Tin Cans

Pasteurized cider is often packed in tin cans. However, they must be lined with a special juice enamel. When a plain tin can is filled with cider, it reacts with the metal and produces an off-flavor. Also a plain tin can will cause a definite fading in cider color. Suppliers of metal cans will provide further information on this type of container. Live steam or hot water should be sprayed into the inverted tin

cans on the processing line prior to filling.

Plastic Containers

Cider is often packed in plastic containers, usually in half-gallon or gallon sizes. These containers

are used for fresh cider and also for cider that is to be refrigerated or frozen. To allow for expansion of the cider if the juice is to be frozen, fill the carton to only 90 percent of capacity. Cartons should be rinsed in clean cold water before filling.

PLANT AND EQUIPMENT DESIGN

In designing or remodelling a cider mill, keep in mind ease of production and sanitation. Cover walls and ceilings with a material that is easily cleaned. Either hardboard or metal sheets are suitable for ceilings; smooth concrete or glazed tile—to a height of 6 feet—are best for the walls.

Use acid and alkali-resistant cement for floors. A smooth surface facilitates cleaning. Slope the floor 1 inch in 8 feet for effective drainage. To insure water carry-off, no part of the floor should be more than 15 feet from a drain. A trough drain along the center length of the room is recommended.

If possible, use equipment of stainless steel, especially for those parts of the press that come in contact with the cider. Many existing cider plants could be improved by installing cooling coils for cider storage tanks, pumps to move cider from the press to the storage room, and bottle-washing facilities.

Rinse and scrub the press racks, then submerge them in a tank of dilute sanitizing solution until the next pressing. The racks may pick up weight from water absorption, but this method insures clean racks.

Wash press cloths thoroughly in cold water, preferably in a washing machine. After washing, place cloths in a dilute sanitizing solution. Rinse press racks and cloths thoroughly with clear water just before the next pressing.

Flush tanks, pipelines, and fillers with clean water immediately after use. When possible, dismantle all pipelines for efficient cleaning. Pipelines can be cleaned in place by flushing with detergent and filling with a sanitizing solution. Scrub tanks and filler, rinse with clean water, and then rinse or spray with a sanitizing solution.

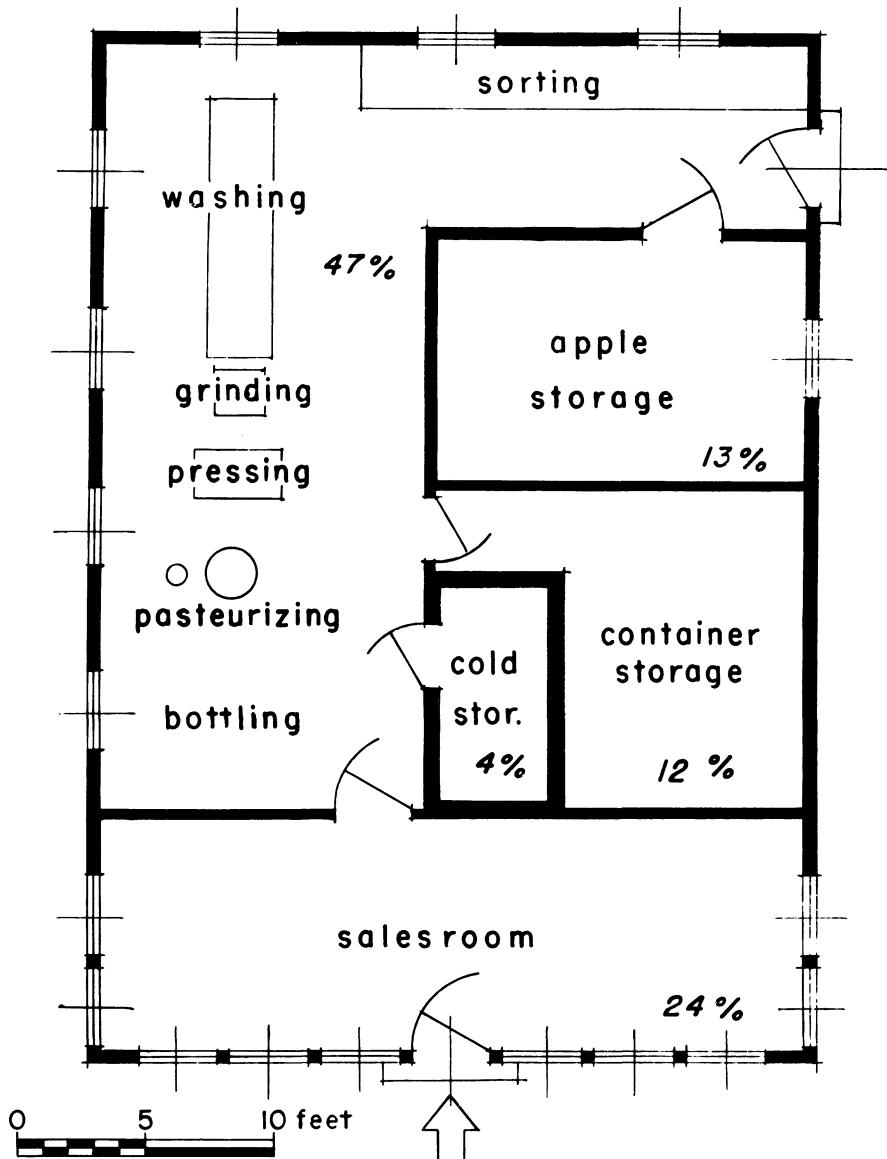
Rinse floors and walls with a hose after the other equipment is cleaned.

SANITATION

The keeping quality of cider is directly related to the sanitation practices observed during the operating season. Unsanitary practices foster the growth of micro-organisms, which cause fermentation or produce undesirable flavors in the final product.

After a day's run, observe the following procedures in cleaning the cider plant:

Dismantle the press for cleaning. Rinse it thoroughly with a hose to remove surface dirt. Scrub all parts of the press thoroughly, using a sanitizing or de-



A suggested floor plan for a cider mill.

tergent-sanitizing solution. Where possible, use hot water for both rinsing and the scrubbing operations.

Sanitizing compounds may be

of the chlorine or quaternary ammonium types. Dairy-cleaning compounds are usually of these types, and they are easily obtained. Directions given by the

manufacturer of the solution for cleaning dairy equipment will be satisfactory for cider plants.

Pomace should not be fed to livestock. It may result in the contamination of milk or meat

with pesticide residues. Since virtually all apples are sprayed, and the pesticides tend to concentrate in the pomace, disposal of the pomace in a pit is recommended.

FLY CONTROL

Control of house flies and vinegar flies is needed during the early fall months. Cover all doors and windows with a fine-mesh screening. Install large fans to force a strong blast of air outward through doorways.

Strict sanitary measures to prevent fly breeding, both inside and outside of the building, should be followed. Without adequate sanitation, no other procedure is completely effective.

Apply residual sprays to surfaces where flies rest outside buildings. Include areas around windows, doors, and loading platforms, but be careful not to contaminate apples or containers. Dimethoate (Cygon), ronnel (Korlan), or other materials approved for surface treatments to control flies, should be diluted and applied as directed on the labels.

Some flies are bound to escape the insecticide and enter the pressroom despite strict sanitation and control. Aerosol sprays

used at the start and close of each operating day should control these flies. For best results, keep the doors and windows of the mill or pressroom closed during spraying to prevent cross currents and ventilation. The aerosol must contain either synergized pyrethrins or dichlorvos. Do not use aerosols that contain DDT, methoxychlor, lindane, chlordane, or any similar material. Aerosol containers of 5-pound capacity are economical. Be sure the aerosol container is labeled for flying insects; sprays designed for crawling insects must not be sprayed into the air. Directions on the label indicate the amount of insecticide needed to protect a given amount of space. Before press operations begin, ventilate the premises.

Resin strips impregnated with dichlorvos (Vapona, DDVT) are effective against flies when used as directed. Results will not be satisfactory if the space is too large for the number of strips or if the air flow is excessive.

PRECAUTIONS

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and

animals—and away from food and feed.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contami-

nated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells.

Dispose of empty pesticide containers promptly. Have them bur-

ied at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.